

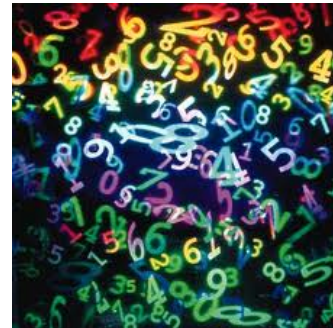
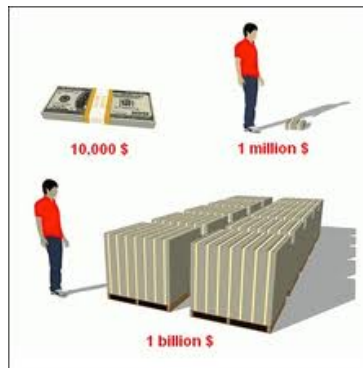
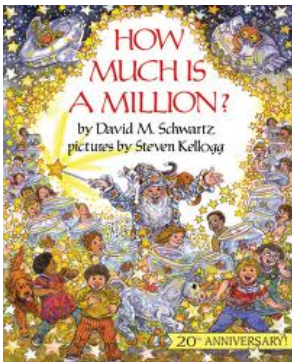
Chapter 9 Exponents & Scientific Notation

9.2 Product of Powers Property

Unit Question: What is the power of powers?

Learner Profile: Reflective

Area of Interaction: Community & Service



I Can Statement:
I can multiply powers with
the same base.



Homework without Fuss

Your parents would like to reward you each day that you complete your homework without fuss. They give you two options:

1. \$5 for each day
2. 1 penny the first day, 2 pennies the second day, 4 pennies the third day, and so on with your pay doubling every day.

There are 18 days that you do this.

Which deal will you agree to? Explain.

1 ACTIVITY: Finding Products of Powers

Work with a partner.

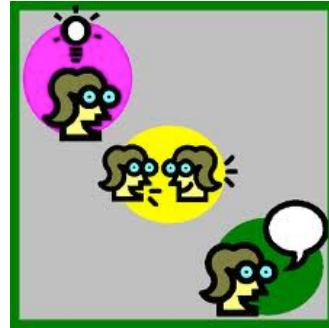
- a. Copy and complete the table.

Product	Repeated Multiplication Form	Power
$2^2 \cdot 2^4$	$2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$	2^6
$(-3)^2 \cdot (-3)^4$	$(-3) \cdot (-3) \cdot (-3) \cdot (-3) \cdot (-3) \cdot (-3)$	$(-3)^6$
$7^3 \cdot 7^2$	$7 \cdot 7 \cdot 7 \cdot 7 \cdot 7$	7^5
$5.1^1 \cdot 5.1^6$	$5.1 \cdot 5.1 \cdot 5.1 \cdot 5.1 \cdot 5.1 \cdot 5.1 \cdot 5.1$	5.1^7
$(-4)^2 \cdot (-4)^2$	$(-4)(-4)(-4)(-4)$	$(-4)^4$
$10^3 \cdot 10^5$	$10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10$	10^8
$\left(\frac{1}{2}\right)^5 \cdot \left(\frac{1}{2}\right)^5$	$\frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2}$	$\left(\frac{1}{2}\right)^{10}$

- b. **INDUCTIVE REASONING** Describe the pattern in the table. Then write a rule for multiplying two powers that have the same base.

Think, Pair, Share

What did you notice through this investigation?



What do you think the rule is for multiplying exponents?

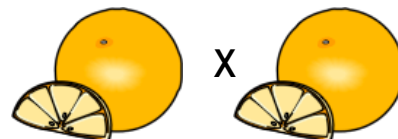
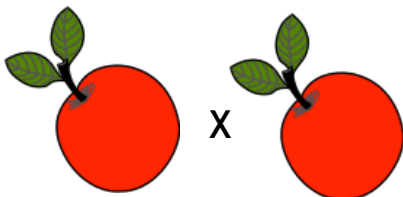
Key Idea

Product of Powers Property

Words To multiply powers with the same base, add their exponents.

Numbers $4^2 \cdot 4^3 = 4^{2+3} = 4^5$

Algebra $a^m \cdot a^n = a^{m+n}$



1

Multiplying Powers with the Same Base

$$\begin{aligned} \text{a. } 2^4 \cdot 2^5 &= 2^{4+5} \\ &= 2^9 \end{aligned}$$

The base is 2. Add the exponents.
Simplify.

$$\begin{aligned} \text{b. } -5 \cdot (-5)^6 &= (-5)^1 \cdot (-5)^6 \\ &= (-5)^{1+6} \\ &= (-5)^7 \end{aligned}$$

Rewrite -5 as $(-5)^1$.
The base is -5 . Add the exponents.
Simplify.

$$\begin{aligned} \text{c. } x^3 \cdot x^7 &= x^{3+7} \\ &= x^{10} \end{aligned}$$

The base is x . Add the exponents.
Simplify.

You try:

$$6^2 \cdot 6^7 \quad 6^9$$

$$-2 \cdot (-2)^3 \quad (-2)^4$$

$$x^2 \cdot x^5 \quad x^7$$

2 Raising a Power to a Power

$$\begin{aligned}\text{a. } (3^4)^3 &= 3^4 \cdot 3^4 \cdot 3^4 \\ &= 3^{4+4+4} \\ &= 3^{12}\end{aligned}$$

Write as repeated multiplication.

The base is 3. Add the exponents.

Simplify.

$$\begin{aligned}\text{b. } (w^5)^4 &= w^5 \cdot w^5 \cdot w^5 \cdot w^5 \\ &= w^{5+5+5+5} \\ &= w^{20}\end{aligned}$$

Write as repeated multiplication.

The base is w . Add the exponents.

Simplify.

You Try:

$$(5^2)^3 \quad 5^6$$

$$(w^5)^4 \quad w^{20}$$

$$(y^4)^6 \quad y^{24}$$

$$(3^4)^3 \quad 3^{12}$$

$$\{(-2)^4\}^3$$

$$\{(-x^5)\}^4$$

3

Raising a Product to a Power

- a. $(2x)^3 = 2x \cdot 2x \cdot 2x$ Write as repeated multiplication.
 $= (2 \cdot 2 \cdot 2) \cdot (x \cdot x \cdot x)$ Group like bases using properties of multiplication.
 $= 2^{1+1+1} \cdot x^{1+1+1}$ The bases are 2 and x. Add the exponents.
 $= 2^3 \cdot x^3 = 8x^3$ Simplify.
- b. $(xy)^2 = xy \cdot xy$ Write as repeated multiplication.
 $= (x \cdot x) \cdot (y \cdot y)$ Group like bases using properties of multiplication.
 $= x^{1+1} \cdot y^{1+1}$ The bases are x and y. Add the exponents.
 $= x^2y^2$ Simplify.

You Try:

$$(4x)^2 \quad 16x^2$$

$$4^2 \cdot x^2$$

$$(4x)(4x)$$

$$(-5k)^2 \quad (-5)^2 k^2$$

$$25k^2$$

$$(2x)^3$$

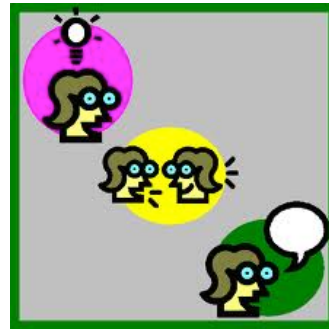
$$(0.5n)^3$$

$$(ab)^5$$

$$\left(\frac{1}{5}k\right)^2 \quad \frac{1^2}{5^2} k^2 \quad \frac{1}{25}k^2$$

Think, Pair, Share

Summarize to your partner the three rules we covered?



I Can Statement:
I can multiply powers
with the same base.



Homework

Textbook p.360-361
4-22even
Textbook p340 odd

